

THE IN-PLACE
POLLUTANTS PROGRAM

A PROGRAM OVERVIEW

- VOLUME 1

MARCH, 1987

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Environment
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Jim Bradley
Minister

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March, 1987

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PREFACE

The In-Place Pollutants Program addresses the impact of contaminants in sediment on overlying water quality and aquatic biota with the aim of developing strategies for the management of contaminated sediments.

This report, Volume I, provides a general overview of the program and companion volumes will provide the following:

Volume II : Background and Theoretical Concepts (March, 1987)

Volume III: Phase 1 Studies (expected April, 1987)

Volume IV : Phase 1 Data Summary (expected April, 1987)

Subsequent studies will be reported in other volumes in the series.

The In-Place Pollutants Program of the Ministry of the Environment is supported in part by funds received from Environment Canada under terms of the Canada-Ontario Agreement(COA) on Great Lakes Water Quality. Activities are coordinated with those of the Federal government under the guidance of the COA Contaminated Sediments Committee.

BACKGROUND

The In-Place Pollutants Program addresses the need to foster our understanding of polluted sediments in relation to their impact on the aquatic ecosystem.

A knowledge of the sediment compartment is an important factor in understanding and ultimately predicting the long-term fate and effects of contaminants in the aquatic system. It was once thought that contaminants in sediment are effectively locked up and unavailable but recent studies have shown that polluted sediment can be a significant source of contaminants to the water column and aquatic organisms.

Contaminants in sediment take on additional significance to the aquatic system in areas where external inputs have been reduced. This is the case in many of the International Joint Commission(IJC) Areas Of Concern throughout the Great Lakes. In 1985, out of 17 Areas of Concern in Ontario, 15 were identified as having a contaminated sediment problem.

DEFINITION

IN-PLACE POLLUTANTS ARE ORGANIC AND INORGANIC TRACE CONTAMINANTS FOUND IN LAKE AND RIVER SEDIMENT

ORIGIN

CONTAMINANTS
ADSORB TO
SEDIMENT
PARTICLES

PARTICLES
SETTLE TO
BOTTOM

SEDIMENTS ARE NOT
ONLY A SINK BUT
ARE A SOURCE
OF CONTAMINANTS

(SEDIMENTS MAY
CONTINUE TO BE A
SOURCE AFTER
POINT SOURCES
HAVE BEEN
ELIMINATED)

SIGNIFICANCE

- 1 PHYSICO-CHEMICAL CHANGES IN SEDIMENT CAN RESULT IN RELEASE OF CONTAMINANTS TO THE WATER COLUMN AFFECTING WATER QUALITY, WATER USE, TOXICITY TO BIOTA, AND CONTAMINANT UPTAKE BY BIOTA.
- 2 BENTHIC ORGANISMS IN SEDIMENT BIOACCUMULATE CONTAMINANTS AND MAY TRANSFER THEM THROUGH THE FOODCHAIN
- 3 CONTAMINANTS IN SEDIMENT CAN BE TOXIC TO BENTHIC ORGANISMS

STUDY APPROACH

One of the key features in the design of the In-Place Pollutants Program was the use of the holistic approach rather than the traditional piecemeal approach of studying individual attributes of the sediment compartment. The holistic approach assesses the physical, chemical and biological aspects of sediment contamination.

1. PHYSICAL

Physical studies determine the types of sediment found in a given area, the possible origin and role of such material as a source or sink of contaminants and the suitability of the material for benthic habitat. In order to understand the role of sedimentary material as a source or sink of contaminants, reliance has been placed on fate and transport models.

2. CHEMICAL

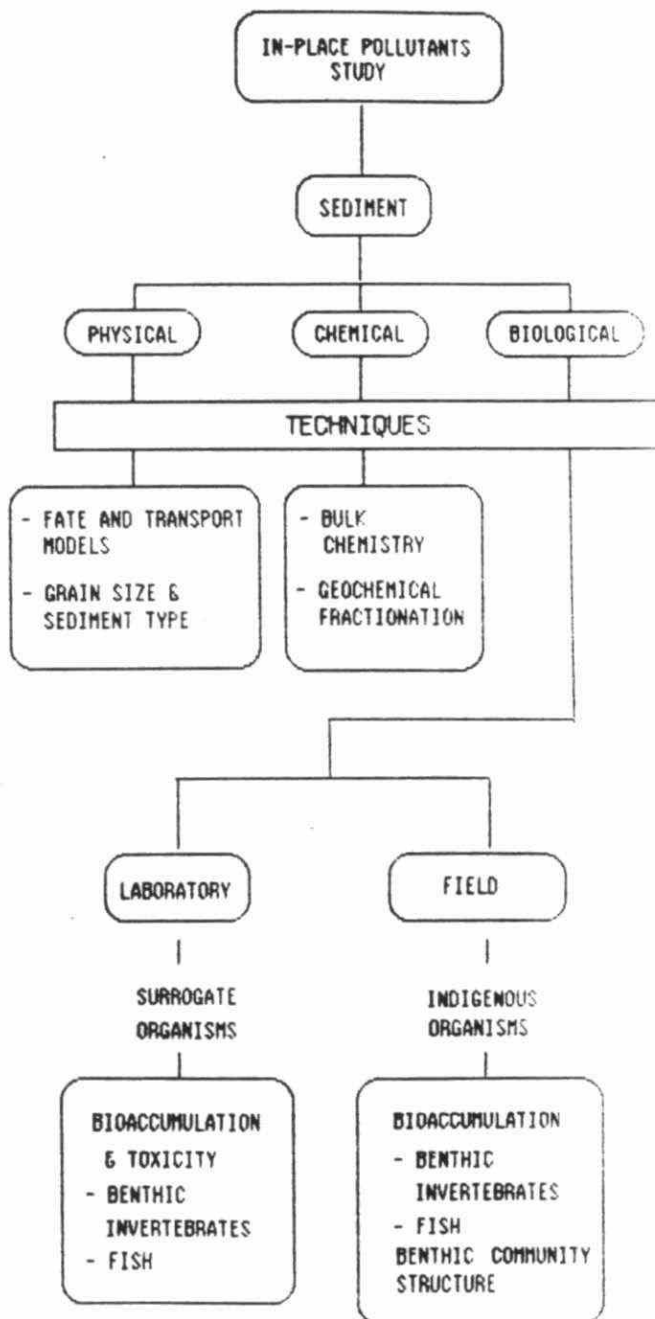
The chemical component includes the development of consistent field procedures and use of sediment quality guidelines as screening mechanisms to determine the level of contamination in sediment.

Bulk chemistry is determined in conjunction with new techniques, such as geochemical fractionation, which may provide a better indication of the availability of metals to the aquatic biota.

3. BIOLOGICAL

The biological component involves determination of bioaccumulation and toxicity of contaminants in sediment to indigenous or surrogate organisms. This is approached through both field and laboratory studies. The laboratory studies involve the use of microcosms to determine the bioaccumulation potential of contaminants in sediment and/or to assess the potential toxicity. The field or in-situ studies examine both bioaccumulation and toxicity by measuring contaminant residues in indigenous species and enumerating benthic populations.

HOLISTIC STUDY



PROGRAM OBJECTIVE

To determine the potential impacts of contaminants in sediment on overlying water quality and on aquatic biota with the aim of developing strategies for the management of contaminated sediment. Protocol documents for laboratory and field studies will be developed, and sediment quality guidelines will be initiated. This will involve the investigation of sediment chemistry, fate and transport of sediment, bottom water chemistry, toxicity of contaminated sediment to biota, and bioaccumulation of contaminants from sediment.

MAJOR TASKS AND ACCOMPLISHMENTS TO DATE

TASKS

ACCOMPLISHMENTS

1. Characterize sediment chemistry in selected areas of known sediment contamination.

The MOE Report titled, Historical Development and Quality of The Toronto Waterfront Sediments was published in 1985. The report characterizes sediment chemistry in Lake Ontario in the Toronto Waterfront area and identifies the need to carry out a program to study contaminants in sediment. As a result, in 1983 the MOE In-Place Pollutants program was initiated. Between 1983 and 1985, sediment from 19 areas located throughout the Great Lakes and 1 inland site (Pottersburg Creek, London) were sampled. Chemical analysis has been completed at all sites.

2. Evaluate the bioaccumulation of contaminants from sediment in selected biota.

Between 1983 and 1985, contaminant residues in selected organisms were determined at the same areas where sediment was collected for characterization. The organisms were both benthic macroinvertebrates and bottom-feeding fish(eg. sculpins).

MAJOR TASKS AND ACCOMPLISHMENTS TO DATE — CONT.

TASKS

3. Evaluate the toxicity of contaminated sediment to selected aquatic biota through the use of in-situ field studies and laboratory testing.

4. Determine the fate of contaminants in sediment by physical transport models.

ACCOMPLISHMENTS

In 1985, a benthic enumeration study was completed for 12 areas in the Great Lakes. The benthic enumeration was designed to determine the distribution and abundance of benthic species, and to determine whether these factors are influenced by the physical and chemical properties of sediment and the overlying water quality. Laboratory bioassessment methods were developed and applied to sediment from 2 areas.

Development of a sediment transport and fate model began in 1985. This model will be able to predict both sediment and contaminant movement.

CURRENT ACTIVITIES (1986)

Field Work:

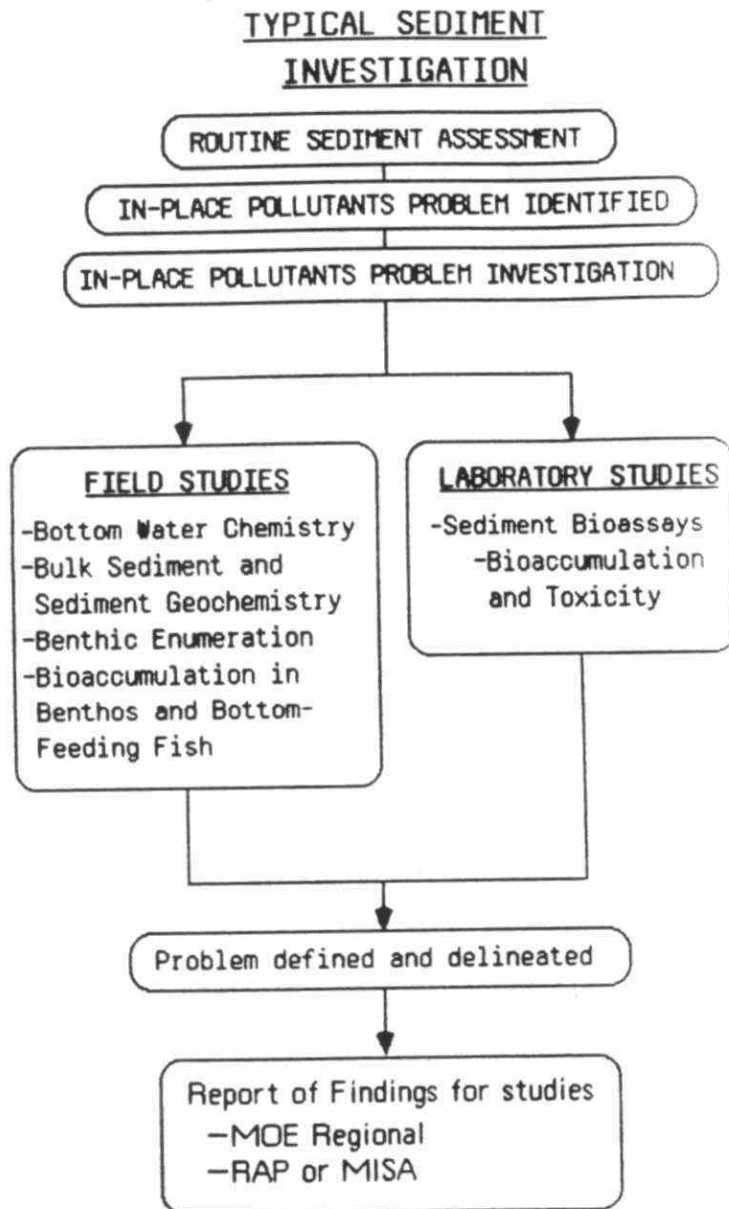
A complete In-Place Pollutants survey including bulk chemistry in sediment, geochemical fractionation in sediment, bottom water chemistry, contaminant determination in benthos and sculpins, and benthic enumeration was carried out at 3 MISA Pilot sites [Kam River in Thunder Bay, St. Lawrence River near Cornwall, St. Clair River] and at one IJC Area Of Concern [Collingwood Harbour in Georgian Bay]. Initial work on sediment characterization was started at a 4th MISA Pilot site [Grand River at Waterloo].

Laboratory Work:

Laboratory sediment bioassessment was carried out for all 6 MISA Pilot sites and 2 Areas Of Concern (Collingwood Harbour in Georgian Bay and Wheatley Harbour in Lake Erie).

Report Preparation:

A report titled In-Place Pollutants Program: A Program Overview Volume I was completed. Draft versions of subsequent reports on the In-Place Pollutants Program - Volumes II - IV were prepared. Statistical evaluation of the In-Place Pollutants data collected in 1984 and 1985 are currently under way.



FUTURE ACTIVITIES

OF THE

IN-PLACE POLLUTANTS PROGRAM

